Strahlenschutz der Bevölkerung bei einer Nuklearkatastrophe

Radiological protection of the public in a nuclear mass disaster

Protection radiologique de la population lors d'une catastrophe nucléaire

Fachverband für Strahlenschutz

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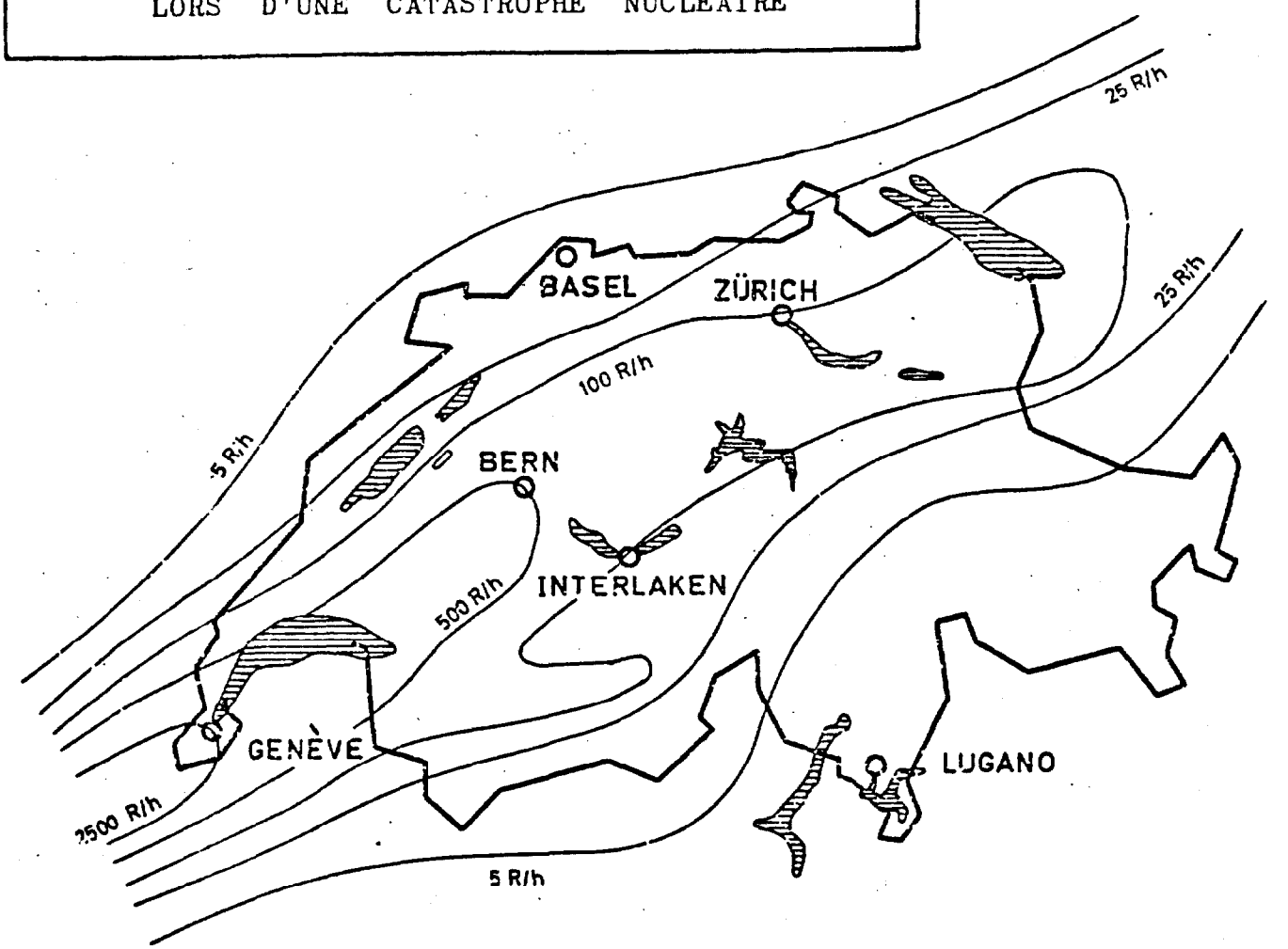
Mitgliedsgesellschaft der International Radiation Protection Association (IRPA)

PROCEEDINGS of a SYMPOSIUM

STRAHLENSCHUTZ DER BEVOELKERUNG
BEI EINER NUKLEARKATASTROPHE

RADIOLOGICAL PROTECTION OF THE PUBLIC
IN A NUCLEAR MASS DISASTER

PROTECTION RADIOLOGIQUE DE LA POPULATION
LORS D'UNE CATASTROPHE NUCLEAIRE



INTERLAKEN, SWITZERLAND, 26 MAY–1 JUNE 1968

PALOMARES TWO YEARS AFTER

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A little over two years have gone by since the accident which has been the subject of two or three books and of news bulletins which traveled around the world several times, and were presented under the most diverse journalistic slants. For that reason, we decided to present an accurate, objective report in Monaco in 1966, on what we saw, did, and thought, for we considered it our inescapable duty to inform all those who take an interest in and live with these problems of protection against ionizing radiation. Since all stories have a second part, we who presented the first report now want to offer its continuation, on behalf of the entire team of coworkers of the Medicine and Protection Division of the Atomic Energy Board, which has worked enthusiastically and efficiently on the different aspects of the problem from the very beginning.

As we said in our first report, the accident took place at a height of about 10.000 meters. The pieces of the planes fell over a very wide area. Many pieces of both planes fell outside the area carefully delimited to determine the zero line. Test made at the points where these pieces or fragments of the planes were found showed no signs of radioactive contamination; such contamination of pieces was found only in the ones that fell within the circumscribed areas. This told us that the dispersion of the radioactive spray did not occur in the upper strata of the athosphere. If this had been the case, the contaminated area would probably also have been much wider, and the contamination would have been characterized quantitatively by two features which were not present in this accident: one, greater uniformity and two, lower values per surface unit. The variations in distribution, following the lines of the direction of the prevailing wind, with decreasing concentrations from the center outwards, and the most densely active areas (2 and 3) at the points of impacts, prove that the explosions of the conventional payload took place when the bombs hit the ground.

The dispersion of the houses and of the scattering of the parts may have changed the probability of the occurrence of a mecanical impact from what it would have been if the houses had been more tightly grouped in any of the affected areas. The lack of this type of accident was very fortunate, for there were no regrettable bodily injuries to the townspeople.

One of the lessons derived from our experience that should not be forgotten is that the pieces or fragments of contamined material, no matter how small, must be meticulously sought, for first of all, they will be found completely unsuspected distances away, and in the second place, many of these fragments, covered with dust which adheres to the usually greasy or damp surface, are very highly active. The potential danger of these fragments is very great, if they are picked up by someone (especially children) who blows on them to remove the dust. Because of the high concentration of the radioactive element (Pu or U) in the dust, that person may very well breathe in a quantity large enough to be significant. It is therefore wise to advise all persons who might find possible contamined fragments or pieces to take care not to handle them.

Another lesson of special interest is that cultivated and wild plant life must be cleaned as well as possible, not only because of their contamination but because they may be hiding such fragments which would otherwise not be visible.

With regard to work on soils, we think that deep-furrow plowing or with the plows used to break still uncultivated ground, will produce sufficient renewal in the layers of soil to dilute considerably the radioactive element. If several cuts are made on successive passes, dilutions so large will be obtained that the land can quickly be farmed again (as happened in our zone 5). We think that the mixing of layers of soil containing different amounts of moisture will result in the formation of denser conglomerates, for the radioactive metal core with high surface activity will adsorb inert particles of silicates or other compunds which surround it and stop it from being directly accessible.

We have reviewed Reitemeier's study presented at the Geneva seminar in 1963, and believe that the greater dispersion of the radioactive elements in those areas which do not require the elimination of densely contaminated surface layers can be achieved by several passes with rotavators under a fine water spray. The entire arable part of zones 3 and 5 was treated in this way, and we verified its high effectiveness. Furthermore, the job takes little time when, of course, the motorized equipment which is nowadays in service practically the world over is used.

A difficult problem was the decontamination of the sides of the houses; however, we solved it by applying several layers of paint. We achieved two ends with this procedure: first, the fixation of the contamination so as to prevent resuspension in the air which would allow it to enter the dwellings through windows or openings in the walls; and second, the interposition of layers of dense material (in this case, calcium oxides) which absorb the weakly penetrating alpha radiation. Successively applied layers of this type of paint will create ever increasing security that traces of radioactive elements will not get into the ambient air. Of course, this procedure will not be so effective with other elements with more penetrating radiations.

We think that the best form of treatment for contamined plants is incineration. However, there must be careful determination and selection of the area in which incineration is to be done, of the density of the amounts of plants to be incinerated (so that all of them will be completely reduced to ashes with no areas left unexposed to fire), and finally of the wind direction and velocity (to prevent the smoke from reaching inhabited areas.). We incinerated the dry bed of the River Almanzora near the beach, taking advantage of the night breezes which blow from land to water.

The case of the town of Villaricos which is separated from Palomares by the river and by a hill, is also interesting. The zero line ends near the river, but nevertheless, we found a contaminated area in the town of Villaricos and its surroundings, with much lower values than in Palomares, but still an area which we did not expect to find. The hill was not enough of an obstacle to prevent a low-concentration radioactive cloud from sailing over it, driven by the strong prevailing wind, and being deposited several kilometers beyond the zero line. Thus, we do not think the suggestion we made in Monaco that an area up to five kilometers away from the zero line be explored is at all exaggerated, but rather very conservative, for in each particular case there will be a possibility of meeting up with surprises of this sort.

Dr. Iranzo will set forth the results and precise data on our work, which has continued uninterrupteldly since we first set foot on those sunny lands.

Now, life there has returned to normal, the disruptions having lasted only as long as was absolutely necessary. If the harvests of their characteristic crops are irregular, this is a result of accidental inconsistencies in the climate,

which this year , for example, was marked by extremely low temperatures at the crucial times of maturation and harvesting of the crops (tomatoes, mainly) and the poor quality of the irrigation water, which is mostly inappropriate, according to the reports of the INIA. That whole area is an outcropping of sea bottom, uplifted by the tilting of the continental shelf many thousands of years ago. The low annual rainfall makes the salinity of the soil and of the running waters, that are trapped in deep wells even higher.

Two years after the accident, we still have four atmospheric dust-collecting stations which, because of the results we have thus far obtained with filter papers placed at a height of one and a half meters above the soil, we are going to change to a height of one half meter, to see whether there is resuspension closer to the ground. We have placed two permanent meteorological recording stations at the two points of greatest interest. We take soil, water, and crop samples as well as samples of wild plant life and non-domestic animals, preferably the ones that can give us the most realistic indication of contamination because of long contact with the soil and plants, such as snails. A modest building is used as the place where we prepare and classify the samples. We have begun some experiments with the INIA to determine whether any of the fertilizers most widely used by the farmers in the area facilitate uptake of Pu by the plants. The presence of Pu in the lungs of a group of people, some of whom were exposed at the beginning and others who were chosen as controls, has been tested with a whole body counter. We also checked for the presence of Pu in three samples of the urine of these people, taken over 24 hours under the most carefully controlled conditions. The results were negative for both the urine analyses and the tests with the whole body counter. We have on file hundreds of readings for soils and plants, houses and a large number of locations, dozens of graphs, and many other facts which we hope to be able to collect some day in a single volume which will give these who have to face similar problems food for thought and study.

The last three lessons that I want to point out here as I conclude this brief report are: one, the importance of dealing with the psychological factor in the common people. Apart from the implications of an economic nature which may or may not be present in each case, it is very important to be solicitous with these people and not to be sparing in employing all possible means to enlighten them and convince them of the groundless nature of some of their fears. In this regard, I want to make mention of the decision I had to make the very day I arrived in the area, regarding the appropriateness of evacuating it completely as a newspaperman had proposed to a mayor of a nearby town. If I had authorized this, I am sure that even this long after, many people would not yet have returned to their homes, and the material and moral damage done to the region would have been incalculable. Hence, such a decision should be pondered very carefully.

The second lesson is that, while the Civil Protection Agencies can supply the personnel and the material equipment for field work, it is the National Atomic Energy Institutions, be they called Headquarters, Commission, or Boards, that should keep strict scientific control of the thousands of details of a technical nature that come up constantly.

The third and last is that well-trained prospecting teams, accustomed to hard work in the country, should always be kept available. I want to emphasize once again how much help we got from our teams, which we would never have had if these teams had had to be organized on the spot.

We hope that our modest contribution, together with that of our Danish collegagues, will provide useful study material and facilitate action in the case of another like or similar accident, which we pray to God will never occur.